

logical Societies, and Society of Arts, of London; the Bureau des Ponts et Chaussées in Paris; the San Fernando Observatory; Dr. Koch and R. Friedlander & Son, of Berlin; J. Kreittmeyer, of Munich; Professor Agassiz, of Cambridge, Massachusetts; Professor Hall, of Albany; the New Jersey Historical Society; the Franklin Institute; Messrs. Blanchard & Lea, J. F. Fisher, T. P. James, C. B. Trego, O. Reichenbach, and F. Leyboldt, of Philadelphia; Mr. J. Lacey Darlington, of Westchester; and the Wilmington Institute.

No. 69 of Volume IX of the Proceedings, just published, was laid on the table by the Secretary.

The death of C. G. C. Reinhardt, of Leyden, a member of the Society, was reported by the Secretary.

A communication intended for publication in the Transactions was presented by Mr. T. P. James, entitled, "On the Mosses of California," by Leo Lesquereux, of Columbus, Ohio, and referred to a committee, consisting of Mr. James, Mr. Durand, and Dr. Bridges, with instructions to report at their earliest convenience.

Communications "On Solar Spots," and "On Breaks in the Visible Record of History of the Variation of Species," by Dr. Reichenbach, were read by the Secretary.

## SOLAR SPOTS.

BY DR. O. REICHENBACH, PHILADELPHIA.

Going over the last volumes of the "London, Edinburgh, and Dublin Magazine of Sciences," I remarked in the number for December, 1860, an article by J. Gregg, F.G.S., on solar spots, in which he mentions that Mr. Wolf has in the "Comptes Rendus," January, 1859, renounced the idea that this phenomenon might be connected with the planetary motions. He finds the hypothesis likely, but must admit that the period of spots, which he presumes to be 11.1 years, is not in accordance with that of the revolution of Jupiter, that the maximum does not at all coincide with the perihelion of that planet—*rather the contrary*—and that he has not been able to find amongst astronomical combinations a period of 11.1 years.

"Silliman's American Journal," volume 25, 1858, page 295 (prior to Mr. Wolf's opinion), contains a note, dated 13th January, 1858, in which I say, that the period of spots depends on the revolution of Jupiter, and varies principally by the influence of Saturn, as the effects of the other eight planets (I assert the existence of so many) being inferior to that of Saturn, must all fall inside *the oscillation* produced by the latter. I have farther shown that the maximum of spots corresponds to the aphelion of Jupiter.

The revolution of Jupiter is 11.86 years. I do not see how the period of spots is shown to be 11.1 years. The time since 1828, the first maximum proved by constant observation, is too short for deducing the exact period, which must be variable. Only a long observation can show it to be identical with that of Jupiter, 11.86.

*Remark.* As the exact period has not been ascertained, we can indulge in the hypothesis, which I, however, feel disposed to reject, that there occur seven maxima within six revolutions of Jupiter, if Saturn steadily advances, and not in the long equally delays the period. For if  $M$  the mass of Jupiter,  $m$  of Saturn,  $D$  and  $d$  their respective distances from the sun,  $\frac{Md}{mD} = 6$ , or the tide-creating force of Saturn being  $\frac{1}{6}$  of that of Jupiter, in the sun there will be 7 maxima instead of 6, if there is only acceleration. The period of spots would be 10.17 years, and the maxima could oscillate two years before and after the aphelion passage of Jupiter, as in the case of an average period of 11.86 they can oscillate 2.4 years.

We can draw some inferences from the time before 1828.

In 1779 the attention of William Herschel was turned to the subject of "spots" by a spot visible with the naked eye. We will suppose that year one of maximum. The aphelion of Jupiter fell in 1780, or the time from 1779 to 1828, the aphelion passage of Jupiter having occurred May, 1827, occupies four revolutions and seventeen months, the maximum having occurred an equal time first before than after the aphelion passage of Jupiter. The period exceeded 11.86 years, as afterwards it has been shorter, a circumstance in favor of the average of 11.86 years. The arbitrary period mentioned by Mr. Gregg gives four periods and 4.5 years, a quite unfavorable result.

Baron Humboldt, in speaking of solar spots, gives a series of observations of different kinds:

43 a. C. n. Death of Cæsar. Dim, cool weather, one year after, political superstition. Falls, however, not two years before the aphelion of Jupiter, and coincides with that of Saturn, and can have been a maximum.

35 p. C. n. Death of the Saviour. No characteristics of sun spots ; terrestrial phenomenon.

358 p. C. n. Local, terrestrial.

360. Local, terrestrial.

409. More like an eclipse.

536. One year and a half after the aphelion of Jupiter, and as long after that of Saturn ; favorable to theory.

567. Somewhat over two years before the aphelion of Jupiter, but coincident with that of Saturn ; most likely a maximum, which is, however, not described by the occurrence.

626. *According to the intelligent and careful Arabian observers, half the disc of the sun remained obscured during eight months. It is evidently the sun which is obscured. The evidence indicates a most intense maximum. In this year coincide the aphelia of Jupiter and of Saturn. This case alone seems fully to confirm the theory. The period 11.86 coincides from 1828 downward.*

807. Coincides with the aphelion of Jupiter, and three years after that of Saturn ; favorable to theory.

840. A little over two years before the aphelion of Jupiter, but coincident with that of Saturn. The small angular distance of the two planets increased the maximum.

934. Local, terrestrial.

1091. A few months before the aphelion of Jupiter.

1096. Could not be a maximum if 1091 was one.

1206. A local phenomenon, terrestrial.

1241. Equally local, terrestrial.

Pending nominations Nos. 494 to 505 were read.

The Committee on Mr. Lesquereux's communication reported in favor of its publication in the Transactions, which on motion was so ordered.

Bills were presented from C. Sherman, Son & Co. for printing the Catalogue, \$411 75, and Proceedings, No. 69, \$227 70, which, on motion of Mr. Fraley, were referred to the Finance Committee, with power to take order thereon.

On motion of Mr. Fraley, the following resolution was adopted :

*"Resolved, That a committee, to consist of the Committee on Finance and the Committee on the Hall, be appointed to take in charge*